8522A

Digital Multimeter

COMPLIES WITH MIL-STD 45662A
AMMENDED YES ____ NO ✓
TECH J. D. Schneeman
APPROVAL [signature] 10-3-89

Calibration Manual

FLUKE®

001.0890

8522A
Digital Multimeter

Calibration Manual

P/N 629220
November 1981
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*For European customers, Air Freight prepaid.

John Fluke Mfg. Co., Inc., P.O. Box C9090, Everett, Washington 98206

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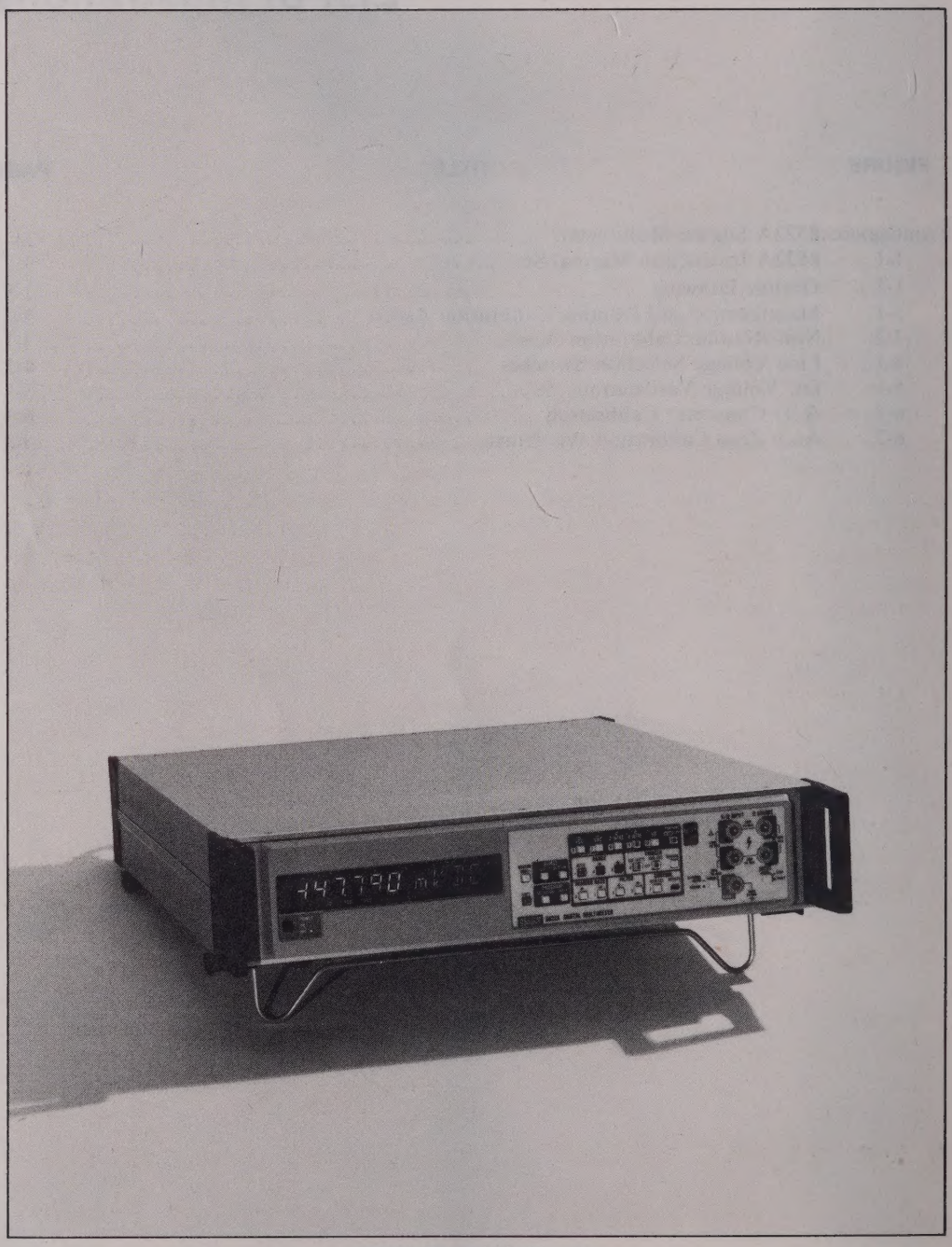

8522A Digital Multimeter

Section 1
Introduction and Specifications

WARNING

THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

1-1. THE 8522A INSTRUCTION MANUAL SET

1-2. The John Fluke Model 8522A Digital Multimeter is documented by a set three manuals: the 8522A Operator's Manual, the 8522A Calibration Manual, and the 8522A Service Manual. The 8522A Operator's Manual introduces the operator to the 8522A, familarizes the operator with all instrument controls, connectors, and indicators, and presents detailed local and remote operating information and procedures. The 8522A Calibration Manual provides general maintenance procedures, Performance Tests, and Calibration Adjustment procedures. The 8522A Service Manual contains the theory of operation, troubleshooting information, a list of replceable parts, and schematics. As Figure 1-1 shows, the three manuals can either be separated for use in different areas or joined together in a single binder.

1-3. The information in this, the 8522A Calibration Manual, is divided into six sections:

1 INTRODUCTION AND SPECIFICATIONS	Introduces the 8522A Instruction Manual Set, lists the recommended test equipment necessary to complete the Performance Tests and Calibration Adjustments, and lists the instrument specifications.
2 SHIPPING AND SERVICE INFORMATION	If there is a problem with your 8522A, how to get it corrected, and how to ship the instrument.
3 ACCESS PROCEDURES	Describes how to gain access to the Calibration Adjustments and general maintenance circuit areas.
4 GENERAL MAINTENANCE	Describes how to replace fuses, select a different line voltage, clean the instrument, etc.
5 PERFORMANCE TESTS	A set of procedures that verify that the 8522A is performing within the specifications listed in Section 1. All of these procedures are completed with the INSTRUMENT COVERS IN PLACE.

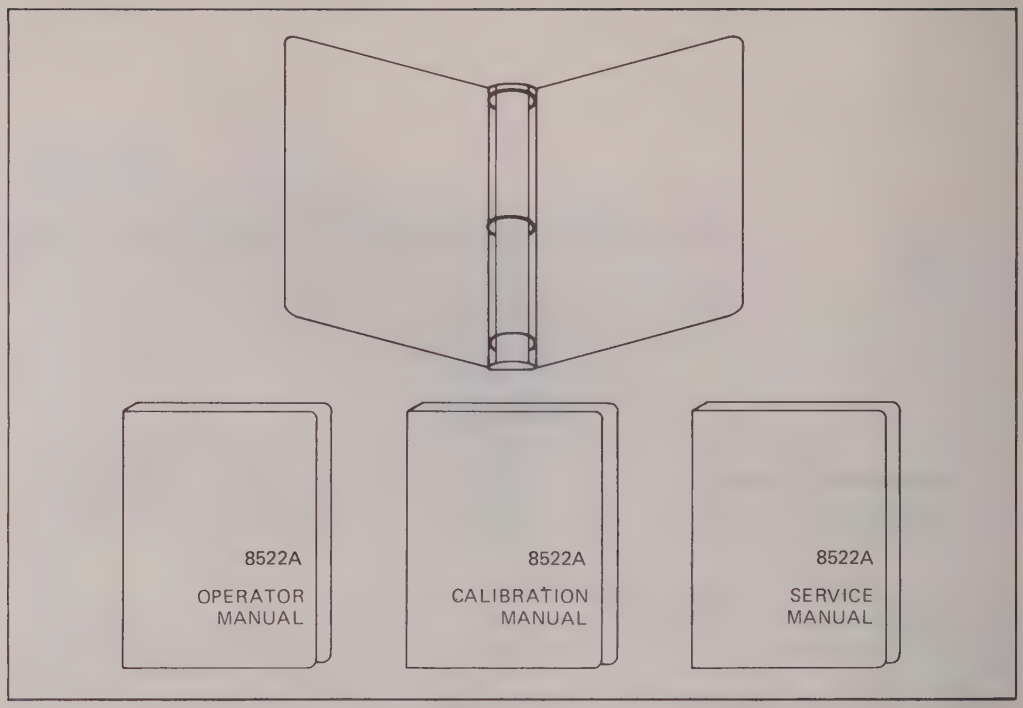

Figure 1-1. 8522A Instruction Manual Set

6 CALIBRATION ADJUSTMENTS — A set of procedures that tell how to perform the 8522A Calibration Adjustments so that the instrument operates within the specifications listed in Section 1.

1-4. LIST OF RECOMMENDED TEST EQUIPMENT

1-5. Table 1-1 lists the test equipment required to complete the Performance Tests and Calibration Procedures described in this manual. Equivalent instruments can be substituted if the recommended models are not available.

Table 1-1. Test Equipment

ITEM	SPECIFICATIONS (MINIMUM)	NOMENCLATURE
DMM	5½ digits 0.005% dc accuracy	FLUKE 8800A
Oscilloscope	General Purpose	TEKTRONIX T900 Series
DC Voltage Standard	0.001% Accuracy	FLUKE 332D or 335D
Ratio Standard	0.1 ppm Resolution, 1 ppm Terminal Linearity	FLUKE 720A
AC Calibrator	≥0.03% Accuracy @ 20 kHz	FLUKE 5200A
Power Amplifier	≥0.44% Accuracy @ 20 kHz	FLUKE 5205A or 5215A
Standard Resistor w/Accessories		ESI 1010 100Ω and 10 kΩ, ESI 1050 1MΩ. ESI SB103 shorting bars, ESI PC101 Parallel Compensation Network
Load	1 MΩ/1 μF	1 MΩ ±1% 1/8 W, mF resistor in parallel with a 1 μF ±20% 10V capacitor

1-6. SPECIFICATIONS

1-7. Table 1-2 lists the 8522A specifications.

Table 1-2. 8522A Specifications

DC VOLTS

Input Characteristics

RANGE	FULL-SCALE	RESOLUTION	INPUT RESISTANCE
100 mV	199.999	1 μV	≥10,000 MΩ
1V	1.99999	10 μV	≥10,000 MΩ
10V	16.0100	100 μV	≥10,000 MΩ
100V	130.100	1 mV	10 MΩ
1000V	1024.00	10 mV	10 MΩ

Accuracy ±(% of input + number of digits)

RANGE	24 HOURS 23°C ±1°C	90 DAYS 18°C to 28°C	1 YEAR 18°C to 28°C	PLUS TEMP. COEFFICIENT PER °C*
100 mV	0.003 +5	0.0005 + 0.5	0.0065 + 6	0.011 + 10
1V	0.003 + 1	0.0005 + 0.15	0.006 + 2	0.011 + 2
10V	0.002 + 1	0.0004 + 0.10	0.005 + 1	0.009 + 1
100V	0.003 + 1	0.0005 + 0.15	0.007 + 2	0.012 + 2
1000V	0.0035 + 1	0.0005 + 0.10	0.0065 + 1	0.011 + 1

*From 22°C to 0°C or 24°C to 50°C, 24 hour specification
From 18°C to 0°C or 28°C to 50°C, 90 day or 1 year specification

High Speed Accuracy ±(% of input + least significant bit)*

RANGE	90 DAYS 18°C to 28°C	PLUS TEMP. COEFFICIENT PER °C*	1 YEAR 18°C to 28°C
100 mV	0.01 + 1	0.015 + 1	0.001 + .1
1V	0.01 + 1	0.015 + 1	0.001 + .05
10V	0.01 + 1	0.015 + 1	0.001 + .05
100V	0.01 + 1	0.015 + 1	0.001 + .05
1000V	0.01 + 1	0.015 + 1	0.001 + .05

*Typical with 60Hz line, remote operation, 500 readings per second, 2-byte binary output with 14 bits of data.

Typical Normal Mode Rejection

LINE FREQ	FILTER SETTLING TIME					
	25 ms	50 ms	100 ms	200 ms	500 ms	1s
50 Hz	65 dB	68 dB	71 dB	80 dB	*83 dB	86 dB
60 Hz	65 dB	68 dB	71 dB	85 dB	*88 dB	91 dB
400 Hz	53 dB	56 dB	60 dB	120 dB	*123 dB	126 dB

*Guaranteed minimum rejection

Common Mode Rejection ..... True 100 dB at 50 Hz and 60 Hz with 1 kΩ unbalance in either lead. Effective CMR is equal to normal mode rejection plus true CMR.

Table 1-2. 8522A Specifications (cont)

Maximum Input ..... ±1000V Peak, HI to LO or GUARD to chassis terminals, and ±200V Peak, GUARD to LO terminals, for any range.

Maximum Reading Rate

OPERATION	RESOLUTION	LINE	READING RATE
Local/Remote	5-1/2 digits	50 Hz 60 Hz	200 rdgs/sec* 240 rdgs/sec*
Remote	4-1/2 digits	50 Hz 60 Hz	>500 rdgs/sec >500 rdgs/sec

*For local operation the 8522A is limited to ½ this rate.
Input Current ≤50 pA for 30 days @ 18°C to 28°C

AC VOLTS (TRUE RMS)

Input Characteristics

RANGE	FULL-SCALE	RESOLUTION	INPUT IMPEDANCE
1V	1.99999	10 μV	1 MΩ,≤100 pF at the V/Ω INPUT terminal
10V	16.0100	100 μV	
100V	130.100	1 mV	
650V	650.00	10 mV	

Accuracy ±(% of input + % of full-scale)**
For 650V range multiply % FS error shown by 1.6

FREQUENCY	24 HOURS 23°C ±1°C			90 DAYS 23°C to 28°C			1 YEAR 18°C to 28°C		
	% OF INPUT	+ % FS AC	+ % FS AC+DC	% OF INPUT	+ % FS AC	+ % FS AC+DC	% OF INPUT	+ % FS AC	+ % FS AC+DC
10 Hz to 20 Hz*	3.0	0.5	0.6	3.0	0.6	0.7	3.5	0.6	0.7
20 Hz to 40 Hz*	0.4	0.3	0.4	0.5	0.5	0.6	0.6	0.6	0.7
40 Hz to 20 kHz	0.08	0.02	0.06	0.1	0.03	0.08	0.15	0.05	0.16
20 kHz to 100 kHz	1.0	0.3	0.4	1.0	0.3	0.4	2.0	0.6	0.8
100 kHz to 300 kHz	2.4	0.6	0.6	2.4	0.6	0.6	4.0	1.0	1.0
300 kHz to 1 MHz	8.0	2.5	2.5	8.0	2.5	2.5	15.0	5.0	5.0

*Assumes smoothing using the Statistics Math Program (#8).
**From 0.1% of range to full scale

Temperature Coefficient ..... 18°C to 0°C to 28°C to 50°C, to 20 kHz.

AC MODE ..... ±(.007% of input +.007% FS)/°C

AC + DC MODE ..... ±(.007% of input +.014% FS)/°C

Maximum Input ..... ±1000V, Peak HI to LO or GUARD to chassis terminals, and ±200V Peak GUARD to LO terminals for any range.

Crest Factor ..... Exceeds 4:1 @ full scale, increasing downscale.

Volt - Hz Product ..... Not to exceed 2 x 10
Not to exceed 177 V/

Table 1-2. 8522A Specifications (cont)

Maximum Reading Rate ..... 10 rdgs/sec. For frequencies <300 Hz use slower reading rates of 5, 2, or 1 RDG/S, to insure stated accuracy.

OHMS

Input Characteristics

RANGE	FULL-SCALE	RESOLUTION	CURRENT THRU UNKNOWN	OPEN CIRCUIT VOLTAGE
10Ω	19.9999	100 μΩ	10 mA	
100Ω	199.999	1 mΩ	10 mA	
1000Ω	1999.99	10 mΩ	1.0 mA	
10 kΩ	19.9999			<8V
100 kΩ	199.999	1Ω	14.5 μA (max)	
1 MΩ	1.99999	10Ω	1.5 μA (max)	
10 MΩ	19.9999	1 kΩ	1.5 μA (max)	

Accuracy ±(% of input + number of digits)

RANGE	24 HOURS 23°C ±1°C	90 DAYS 18°C to 28°C	1 YEAR 18°C to 28°C	PLUS TEMP. COEFFICIENT PER°C
10Ω	0.0045 + 6	0.0080 + 7	0.0140 + 12	0.0007 + 2.0
100Ω	0.0035 + 2	0.0070 + 2	0.0125 + 3	0.0007 + 0.2
1000Ω	0.0035 + 2	0.0070 + 2	0.0125 + 3	0.0007 + 0.2
10 kΩ	0.0035 + 2	0.0070 + 2	0.0125 + 3	0.0007 + 0.2
100 kΩ	0.0040 + 2	0.0090 + 2	0.0140 + 3	0.0012 + 0.2
1 MΩ	0.0090 + 2	0.0160 + 2	0.0200 + 3	0.0020 + 0.2
10 MΩ	0.0300 + 1	0.0440 + 1	0.0450 + 3	0.0030 + 0.2

*From 18°C to 0°C or 28°C to 50°C

Maximum Input ..... ±400V peak for any range.

Maximum Reading Rate ..... 10/SEC at 100 KΩ and above.

OPERATION	RESOLUTION	LINE	READING RATE
Local/Remote	5-1/2 digits	50 Hz 60 Hz	200 rdgs/sec* 240 rdgs/sec*
Remote	4-1/2 digits	50 Hz 60 Hz	>500 rdgs/sec >500 rdgs/sec

*For local operation the 8522A is ½ this rate.

CONDUCTANCE

Range ..... 100 nS

Full-Scale ..... 202.00 nS

Resolution ..... 0.01 nS

Table 1-2. 8522A Specifications (cont)

Accuracy ±(% of input + number of digits)

24 HOURS 23°C ±1°C	90 DAYS 18°C to 28°C	1 YEAR 18°C to 28°C	*PLUS TEMP. COEFFICIENT PER°C
0.04 + 5	0.05 + 5	0.06 + 5	0.004 + 1

*From 18°C to 0°C or 28°C to 50°C

Maximum Input ..... ±400V peak

Maximum Reading Rate ..... 10 rdgs/sec

EXTERNAL REFERENCE

Operating Range ..... ±0.5V dc to ±33V dc as long as external reference is within ±16.5V of input LO terminal.

Input Impedance ..... 10,000 MΩ between external reference HI or LO terminals and input LO terminals.

Accuracy

X-REF VOLTAGE	ACCURACY
16.5V to 33V	±(A + B + 20 ppm)
0.5V to 16.5V	±[A + B + (400 ppm - Vref)]

NOTE: A = DC 10 volt range accuracy
B = Input voltage or resistance range accuracy

Maximum Input ..... ±180V peak between external reference HI or LO and input LO; ±360V peak between external reference HI and LO.

TRANSFER ACCURACY ..... The following accuracy specifications apply when:
Filter settling time is 500 or 1000 ms.
Measurements are made more than 2 hours after warm-up.
Measurements are made within one range.
Standard is checked at least every hour.
Ambient temperature stability within ±1°C.

DC Voltage

RANGE	±(% of input + number of digits)
100 mV	0.0020 + 4
1V	0.0020 + 1
10V	0.0010 + 2
100V	0.0020 + 1
1000V	0.0020 + 1

Table 1-2. 8522A Specifications (cont)

AC Voltage (all ranges)

FREQUENCY	±(% of input + number of digits)
10 Hz to 20 Hz	1.0 + 0.2
20 Hz to 40 Hz	0.1 + 0.1
40 Hz to 20 kHz	0.005 + 0.007
20 kHz to 100 kHz	0.100 + 0.030
100 kHz to 1 MHz	0.500 + 0.060

AC Voltage, DC Coupled ..... Same as AC Voltage except 40 Hz - 20 kHz, 0.005 + 0.010.

Resistance

RANGE	±(% of input + number of digits)
10Ω	0.0030 + 5
100Ω	0.0020 + 2
1000Ω	0.0020 + 2
10 kΩ	0.0020 + 2
100 kΩ	0.0020 + 2
1 MΩ	0.0050 + 2
10 MΩ	0.0100 + 1

Conductance ..... ±(0.02% of input +0.02 nS)

GENERAL

Interface ..... Remote interface is standard.

Temperature ..... 0°C to 50°C operating; -25°C to 75°C non-operating.

Relative Humidity ..... ≤95% at 25°C, ≤75% at 40°C, ≤45% at 50°C.

Shock and Vibration ..... Meets MIL-T-28800B for type 111, Class 5, style E.

Power ..... 100, 120, 220, or 240V ac, ±10%; 50, 60, or 400 Hz ±5%, ≤50W.

Size ..... 8.89 cm H/47.00 cm L/43.18 cm W -- (3-1/2 in H/18-1/2 in L/17 in w) See Figure 1-2.

Weight ..... 9.56 kg (21 lbs)

Protection Class Code 1 ..... Relates solely to insulating or grounding properties in IEC 348.

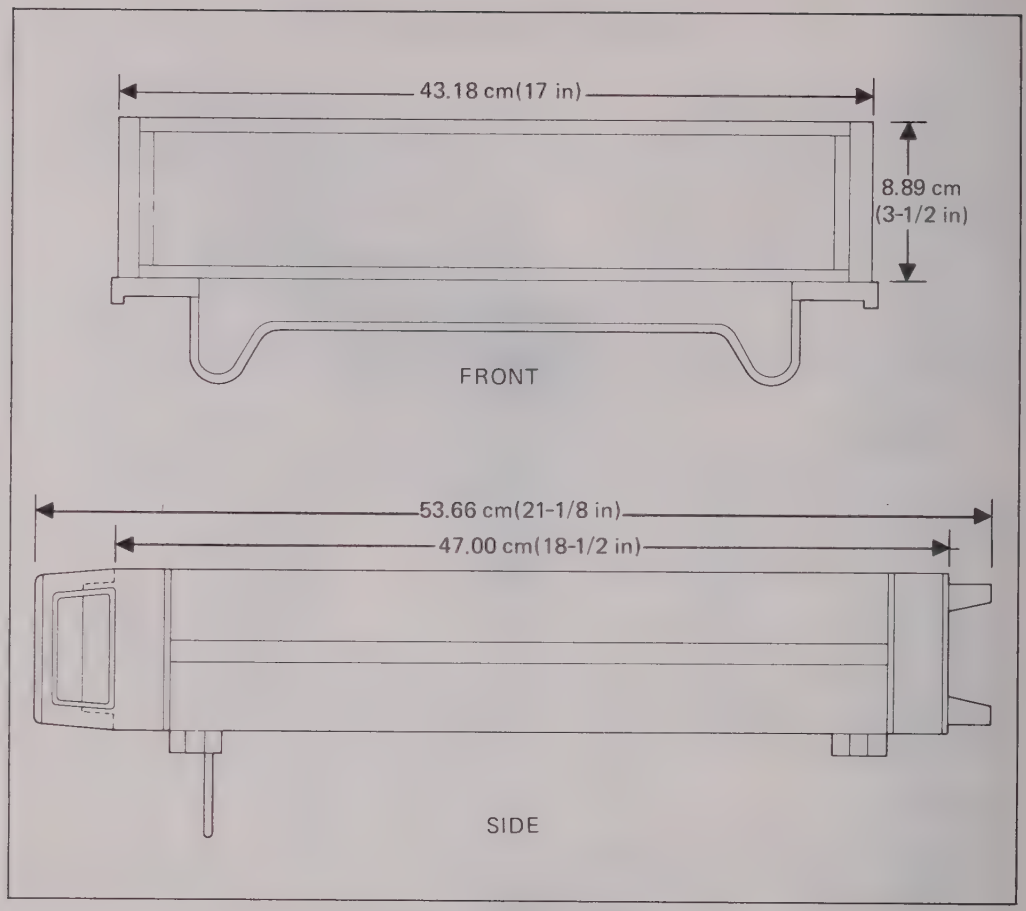

Figure 1-2. Outline Drawing

Section 2
Shipping and Service Information

2-1. SHIPPING INFORMATION

2-2. The 8522A is packaged and shipped in a foam-packed container. When you receive the 8522A, inspect the instrument thoroughly for possible shipping damage. Special instructions for inspection and claims are included on the shipping container.

2-3. If reshipment is necessary, use the original container. If the original container is not available, order a new container from John Fluke Mfg. Co., Inc.; P.O. Box C9090, Everett, Washington 98206; telephone (206) 342-6300.

2-4. SERVICE INFORMATION

2-5. Each John Fluke Model 8522A Digital Multimeter is warranted for a period of one year upon delivery to the original purchaser. The WARRANTY is located at the front of this manual.

2-6. Factory authorized calibration and service for each Fluke product is available at various worldwide locations. A complete list of these service centers is located at the rear of this manual. If requested, the customer will be provided with an estimate before any work begins on instruments that are beyond the Warranty period.

2-7. QUESTIONS

2-8. For additional information, contact your nearest John FlukeSales Representative (see rear of manual) or the John Fluke Mfg. Co., Inc. at the address or telephone number given above.

Section 5
Performance Test

5-1. INTRODUCTION

5-2. The following paragraphs contain a performance verification test which compares the instrument's performance to the specifications given in Section 1 of this manual. The test is recommended as an acceptance test when the unit is first received, and later as a calibration procedure to verify instrument accuracy at the scheduled calibration periods, either the normal 90 days or the alternates, 24 hours or 1 year. It is also useful as an aid in troubleshooting.

5-3. Test equipment required for the performance test is listed earlier in Table 1-1. If the recommended equipment is not available, comparable instruments with equivalent specifications may be substituted. To ensure optimum results, the test must be performed at an ambient temperature of 22 or 24 degrees Celsius, with a relative humidity of less than 70%. Also, the instrument should be allowed to warm-up for at least 1 hour before starting the performance test.

5-4. If the instrument does not meet the performance test, troubleshooting, repair, and/or calibration adjustment is indicated. Procedures for calibration adjustment are given later in this manual. Troubleshooting procedures are given in the Service Manual.

5-5. EQUIPMENT PREPARATION

5-6. Perform the following procedure prior to beginning the performance test:

1. Verify the instrument is set for the applicable line voltage using the procedure previously given.

2. Install any guard or outer covers not in place.

3. Connect the instrument to the input line power.

4. Depress the POWER switch to apply line voltage to the instrument.

5. Select Front Panel inputs and NORMAL guard.

6. Allow the instrument to operate for at least 1 hour before beginning the test.

5-7. ZERO VERIFICATION

5-8. Use the following procedure to verify proper meter zeroing:

1. Select the DC Voltage Function and the 100 mV range. The 2 reading per second rate and 500 msec filter are selected automatically with the function.

2. Short the 8522A input terminals.

3. Perform steps 1 through 6 of Table 5-1.

4. Remove the short from the 8522A input terminals.

Table 5-1. Zero Verification

STEP	FUNCTION	RANGE	READING RATE	INPUT	DISPLAY READING
1	V DC	100 mV	2/sec	Short	.000 mV ±6 μV (6 digits)
2	V DC	100 mV	10/sec	Short	.000 mV ±6 μV (6 digits)
3	V DC	1V	2/sec	Short	.00000V ±20 μV (2 digits)
4	V DC	10V	2/sec	Short	.0000V ±100 μV (1 digit)
5	V DC	100V	2/sec	Short	.000V ±2 mV (2 digits)
6	V DC	1000V	2/sec	Short	.00V ±10 mV (1 digit)

5-9. DC VOLTS VERIFICATION

5-10. Use the following procedure to verify proper operation of the V DC measurment function:

1. Connect the equipment as shown in Figure 5-1.

2. Set the DC Voltage Calibrator controls for a 10V output and set the Ratio Standard to .0100000.

3. Select the DC volts function and the 100 mV range. The 2 readings per second rate and 500 msec filter are selected automatically with the function.

4. Select Operate on the DC Voltage Calibrator.

5. Perform step 1 through 10 of Table 5-2, changing the ratio standard and 8522A range settings as required. Record the displayed reading in step 10 of the table.

6. Select a ratio standard of .088888 and a DC Voltage Standard output (approximately 100 volts) that obtains the recorded display obtained in step 5 above, i.e., step 10 of Table 5-2.

7. Perform step 11 of Table 5-2, setting the Ratio Standard and 8522A range as required.

8. Disconnect the Ratio Standard from the equipment and connect the DC Voltage Standard directly to the 8522A input terminals, output HI to input HI and LO to LO.

9. Perform the steps in Table 5-3, changing the DC Voltage Standard output and 8522A range settings as required.

10. Disconnect the DC Voltage Standard from the 8522A.

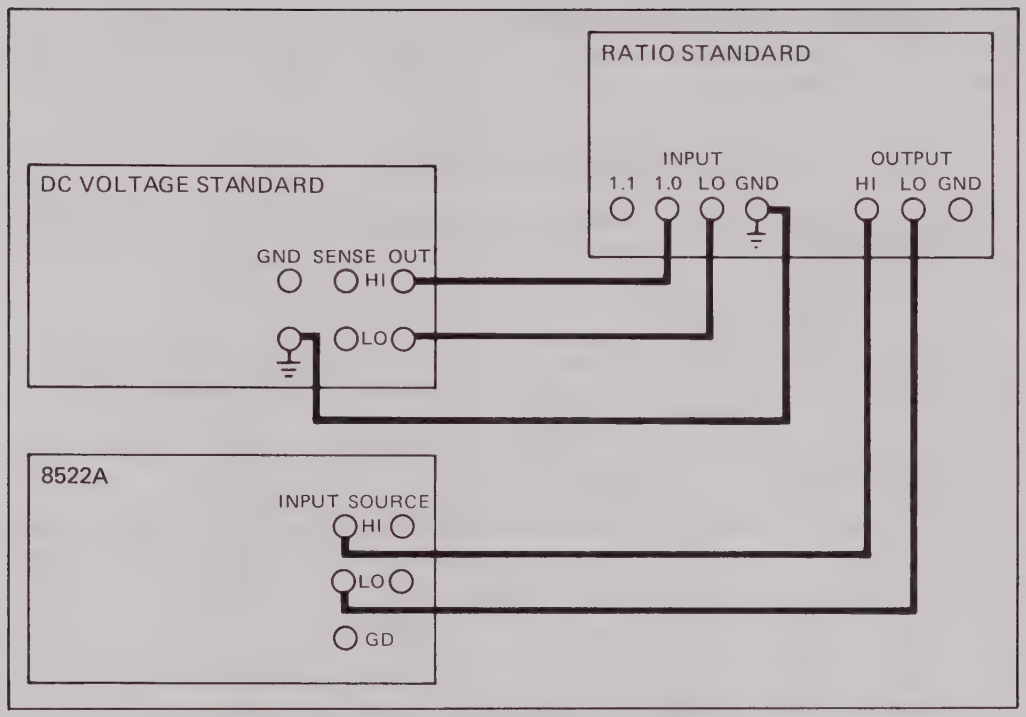

Figure 5-1. DC Voltage Verification

Table 5-2. Low DC Volts Verification

STEP	RANGE	RATIO STANDARD	INPUT	DISPLAY READING
1	100 mV	.0100000	100 mV	100 mV ±12 μV (12 digits)
2	1V	.0111110	.11111V	.11111V ±30 μV (3 digits)
3	1V	.222220	.22222V	.22222V ±30 μV (3 digits)
4	1V	.0444440	.44444V	.44444V ±50 μV (5 digits)
5	1V	.0888880	.88888V	.88888V ±70 μV (7 digits)
6	1V	.1111110	1.11111V	1.11111V ±90 μV (9 digits)
7	10V	.111110	1.1111V	1.1111V ±.2 mV (2 digits)
8	10V	.22220	2.2222V	2.2222V ±.2 mV (2 digits)
9	10V	.444440	4.4444V	4.4444V ±.3 mV (3 digits)
10	10V	.888880	8.8888V	8.8888V ±.5 mV (5 digits)
11	10V	.111111	11.1111V	11.1111V ±.7 mV (7 digits)

Table 5-3. High DC Volts Verification

STEP	DC VOLTAGE STANDARD OUTPUT	8522A RANGE	DISPLAY READING
1	11.111V	100V	11.111V ±3 mV (3 digits)
2	22.222V	100V	22.222V ±4 mV (4 digits)
3	44.444V	100V	44.444V ±5 mV (5 digits)
4	88.888V	100V	88.888V ±8 mV (8 digits)
5	111.111V	100V	111.111V ±10 mV (10 digits)
6	111.11V	1000V	111.11V ±20 mV (2 digits)
7	222.22V	1000V	222.22V ±20 mV (2 digits)
8	444.44V	1000V	444.44V ±40 mV (4 digits)
9	888.88V	1000V	888.88V ±70 mV (7 digits)
10	1000.00V	1000V	1000.00V ±80 mV (8 digits)

5-11. RESISTANCE VERIFICATION

5-12. Use the following procedure to verify proper operation of the resistance measurements functions:

1. Select the Ω 4-wire function and 10Ω range. Select one reading per second, which automatically selects the 1000 msec filter.

2. Short the V/Ω INPUT HI and LO leads, the Ω SOURCE HI and LO leads and then connect the shorted leads with a jumper.

3. The 8522A display reads .0000 ±0.7 mΩ (7 digits).

4. Select the 2 readings per second rate, which automatically selects the 500 msec filter.

5. Perform steps 1 through 7 of Table 5-4, applying the Standard Resistance and selecting the listed 8522A range.

6. Compute the value of the 10 MΩ standard resistor in nano-siemens by dividing 1 by the corrected standard value, i.e., take the reciprocal of the corrected standard value. The result should be approximately 100 nS.

7. Perform step 8 of Table 5-4.

8. Disconnect the Standard Resistor from the 8522A

Table 5-4. Resistance Verification

STEP	NOMINAL STANDARD RESISTOR VALUE	8522A RANGE	CORRECTED STANDARD VALUE READING ± TOLERANCE
1	10Ω	10 ohm	10Ω ±1.5 mΩ (15 digits)
2	100Ω	100 ohm	100Ω ±9 mΩ (9 digits)
3	1000Ω	1000 ohm	1000Ω ±90 mΩ (9 digits)
4	10 kΩ	10 kohm	10 kΩ ±.9Ω (9 digits)
5	100 kΩ	100 kohm	100 kΩ ±11Ω (11 digits)
6	1 MΩ	1 Mohm	1 MΩ ±180Ω (18 digits)
7	10 MΩ	10 Mohm	10 MΩ ±5 kΩ (5 digits)
8	10 MΩ	100 nS	100nS ±.10nS (10 digits)

5-13. AC VOLTAGE VERIFICATION

5-14. Use the following procedure to verify proper operation of the V AC function:

1. Select the AC Volts function and the 1 volt range. The 2 readings per second rate and 500 msec filter are selected automatically with the function.

2. Connect the AC Calibrator output to the 8522A input terminals.

3. Perform step 1 through 15 of Table 5-5, setting the AC Calibrator output and 8522A range as required.

4. Disconnect the AC Calibrator from the 8522A.

5. Connect the AC Calibrator/Power Amplifier combination output to the 8522A input terminals.

6. Perform steps 16 through 19 of Table 5-5, setting the AC Calibrator output and 8522A range as required.

7. Disconnect all test equipment from the 8522A.

Table 5-5. AC Voltage Verification

STEP	AC CALIBRATOR OUTPUT		8520A RANGE	DISPLAY READING BETWEEN:
	VOLTAGE	FREQUENCY		
1	1.100000V	40.00 Hz	1V	1.09830 — 1.10170 (170 digits)
2	1.000000	20.00 kHz	1V	0.99840 — 1.00160 (160 digits)
3	1.000000V	100.00 kHz	1V	0.98400 — 1.01600 (1600 digits)
4	1.000000V	300.00 kHz	1V	0.96400 — 1.03600 (3600 digits)
5	1.000000V	1.000 MHz	1V	0.87000 — 1.1300 (13,000 digits)
6	2.00000 mV	20.000 kHz	1V	.00140 — .00260 (60 digits)
7	10.00000V	1.0000 kHz	10V	9.9852 — 10.0148 (148 digits)
8	10.00000V	20.000 kHz	10V	9.9852 — 10.0148 (148 digits)
9	10.00000V	100.00 kHz	10V	9.8520 — 10.1480 (1480 digits)
10	10.00000V	300.00 kHz	10V	9.6640 — 10.3360 (3360 digits)
11	10.00000V	1.0000 MHz	10V	8.8000 — 11.2000 (12000 digits)
12	100.0000V	1.0000 kHz	100V	99.861 — 100.139 (139 digits)
13	100.0000V	20.000 kHz	100V	99.861 — 100.139 (139 digits)
14	100.0000V	100.00 kHz	100V	98.610 — 101.390 (1390 digits)
15	50.0000V	200.00 kHz	100V	48.020 — 51.980 (1980 digits)
16	600.0000V	1.0000 kHz	1000V	599.10 — 600.90 (90 digits)
17	600.0000V	20.000 kHz	1000V	599.10 — 600.90 (90 digits)
18	600.0000V	30.000 kHz	1000V	590.93 — 609.07 (907 digits)
19	100.0000V	100.00 kHz	100V	95.93 — 104.07 (407 digits)

5-15. AC + DC VOLTAGE VERIFICATION

5-16. Use the following procedure to verify proper operation of the V AC + DC function:

1. Select the V AC + DC function and the 1 volt range. The 2 reading per second rate and 500 msec filter are selected automatically with the function.

2. Connect the DC Voltage Standard output to the 8522A input terminals.

3. Perform steps 1 through 4 of Table 5-6, setting the DC Voltage Standard output as required.

4. Disconnect the DC Voltage Standard from the 8522A.

5. This completes the performance test of the 8522A.

Table 5-6. AC + DC Voltage Verification

STEP	DC VOLTAGE STANDARD OUTPUT	DISPLAY READING BETWEEN:
1	+0.002 Vdc	+0.00079 & +0.00321 (±121 digits)
2	-0.002 Vdc	-0.00079 & -0.00321 (±121 digits)
3	-1.9 Vdc	-1.89690 & -1.90310 (±310 digits)
4	+1.9 Vdc	+1.89690 & +1.90310 (±310 digits)

Disregard ± sign AS PER FLUKE CONVERSATION 10-19-84 09351

Section 6
Calibration Adjustments

6-1. ROUTINE CALIBRATION ADJUSTMENTS

6-2. Introduction

6-3. The calibration adjustment procedures given in the following paragraphs should be performed after repair of the 8522A and/or when the unit fails the performance-test requirements. If the unit will not respond to, or meet the limits of the adjustment procedures, troubleshooting and repair is indicated. Equipment required for the calibration adjustments is listed earlier in Table 1-1.

6-4. All calibration adjustments are accessible when the top cover is removed from the 8522A. The locations of the assemblies, test points, and adjustments that must be accessed to complete the routine calibration adjustment procedures are placarded on the instrument guard cover.

6-5. To ensure optimum results, the calibration adjustments must be performed at an ambient temperature of 22 to 24 degrees Celsius, with a relative humidity of less than 85%. Also the unit should be allowed to warm-up for at least 1 hour before starting the adjustments procedures.

6-6. Instrument accuracies during the first 24 hours after calibration and for one year after calibration are given in the instrument specification. If accuracies within either of these levels are desired the calibration interval can be adjusted accordingly.

6-7. The 8522A contains three calibration procedures (+5V Power Supplies and Auto Zero) that are performed at the factory and do not require further adjustment unless components are replaced within thecircuit. These adjustments,, and the special handling required, are detailed at the end of the calibration procedure in a paragraph titled 'Non-Routine Calibration Adjustments'.

6-8. Calibration (Cal) Digit

6-9. When selected, the Cal digit appears at the left position of the alphanumeric display to add an additional digit of resolution. This moves the displayed data one position to the right, truncating the right character. The Cal digit is used in the calibration of the dc volt and ohms features. It is switch selectable with an internal push-push switch and is accessable only with the top cover removed.

6-10. Designated S1 on the Digital PCB, the switch causes the Cal digit feature to change states, enabling it if it had been disabled, or disabling it if it had been enabled. The Cal digit feature is automatically disabled if power is removed or a RESET occurs. Depression of the switch is required to re-enable the feature. The Cal digit feature cannot be selected in remote operation.

6-11. Routine Calibration Preparation

6-12. Prepare the 8522A for routine calibration using the following procedure:

1. Perform the Routine Calibration Access procedure given in Section 3.

NOTE

Do not remove the inner guard cover for a routine calibration.

2. Apply power to the 8522A and allow the instrument to warm-up for 1 hour before beginning the adjustment procedure.

NOTE

The ambient temperature during the warm-up period and the subsequent calibration should be between 22° C and 24° C with the relaitve humidity less than 70%.

6-13. Reference Supply

6-14. Use the following procedure to perform calibration adjustments on the Reference Supply:

1. Connect the test DMM to TP504 (HI) and TP501 (LO).

2. Depress the RESET keyswitch twice, holding it depressed the second time, short the instrument input terminals. Maintain this condition until the adjustment procedure is complete.

3. Adjust R503 POS REF for a test DMM reading of +6.5000V dc.

4. Connect the test DMM to TP501 (HI) and TP503 (LO).

5. Adjust R504 NEG REF for a test DMM reading of +6.5000V dc.

6. Release the RESET keyswitch and remove the test DMM from the instrument.

6-15. A/D Converter

6-16. Use the following procedure to complete the A/D Converter calibration adjustments:

1. Select the volts dc function, the 10V range, the 2 reading/sec rate, the 1000 msec filter, and the Cal digit feature, in that sequence.

2. Short the instrument input terminals.

3. Adjust R513 for an instrument display of .0000 0 ±2 Cal digits.

4. Connect the equipment as shown in Figure 6-1, i.e., with the DC Calibrator output connected to the Ratio Standard input LO, and the DC Calibrator output LO to the Ratio Standard 1.0 input.

5. Set the Ratio Standard to .8100000.

6. Select a +10.00000V DC Calibrator output.

7. Adjust R522 for an instrument display of -8.1000 0 ±2 Cal digits.

8. Set the DC Calibrator to STANDBY then reverse the output leads at the DC Calibrator. Return the DC Calibrator to OPERATE to obtain an instrument input of +8.1000 0V dc.

9. Adjust R504 for an instrument display of +8.1000 0 ±2 Cal digits.

10. Perform steps 6 through 9 until both readings are within the stated tolerance without adjustment.

11. Perform the checks and adjustments in table 6-1.

12. Select a ratio standard setting of 0.0800000 and a DC Voltage Calibrator output of 100V dc.

13. Adjust the DC Voltage Calibrator for an 8522A display of 8.0000 0 ±2 Cal digits.

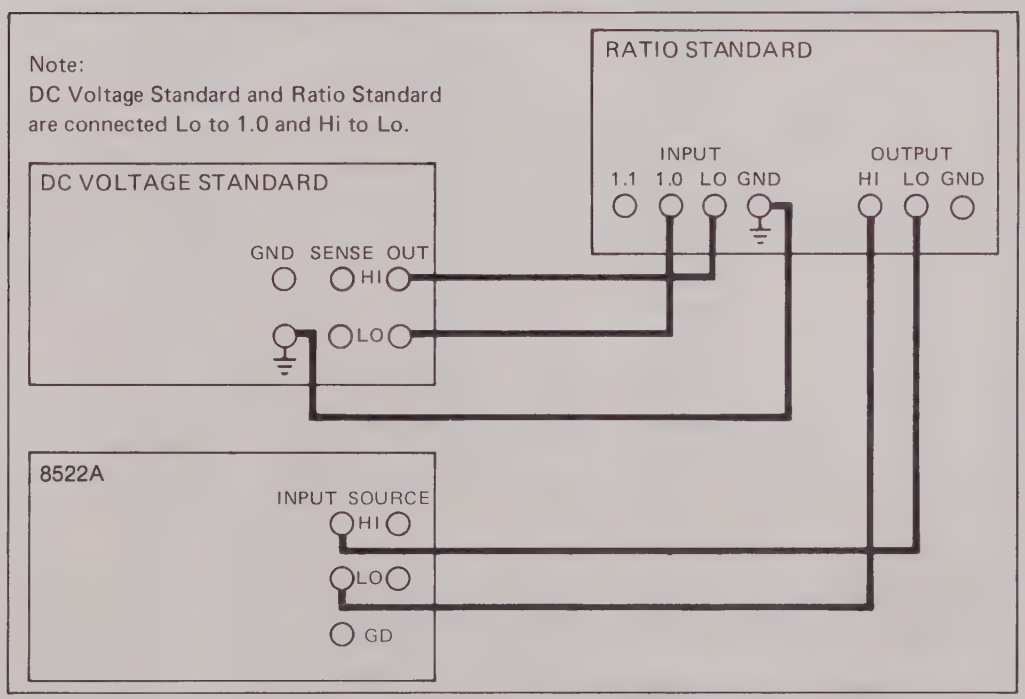

Figure 6-1. A/D Converter Calibration

Table 6-1. A/D Converter Calibration

	VOLTAGE CALIBRATOR SETTING	RATIO STD. SETTING	8522A INPUT	ADJUSTMENT	DISPLAY ±CAL DIGITS
1	+10V	.4100000	4.1V	R521	4.1000 0 ±2
2	+10V	.2100000	2.1V	R520	2.1000 0 ±2
3	+10V	.1100000	1.1V	R519	1.1000 0 ±2
4	+10V	.0600000	0.6V	R518	.6000 0 ±2
5	+10V	.0300000	0.3V	R527	.3000 0 ±2

14. Verify the display readings in Table 6-2. There are no adjustments for these readings.

15. Set the DC Calibrator to STANDBY then reverse the DC Calibrator output leads. Return the DC Calibrator to OPERATE to obtain a negative input to the 8522A.

16. Repeat the steps in Table 6-2 and verify that the readings are as shown, but of a negative polarity.

17. Depress the CAL switch to disable to the CAL Digit feature.

18. Disconnect the test equipment from the instrument.

Table 6-2. A/D Converter Tests

STEP	RATIO STANDARD SETTING	8522A INPUT	DISPLAY ±CAL DIGITS
1	.0100000	1.0V	1.0000 0 ±2
2	.0200000	2.0V	2.0000 0 ±2
3	.0300000	3.0V	3.0000 0 ±4
4	.0400000	4.0V	4.0000 0 ±2
5	.0500000	5.0V	5.0000 0 ±4
6	.0600000	6.0V	6.0000 0 ±6
7	.0700000	7.0V	7.0000 0 ±6
8	.0800000	8.0V	8.0000 0 ±2
9	.0900000	9.0V	9.0000 0 ±8
10	.1000000	10.0V	10.0000 0 ±10
11	.1100000	11.0V	11.0000 0 ±12
12	.1200000	12.0V	12.0000 0 ±15
13	.1300000	13.0V	13.0000 0 ±15
14	.1400000	14.0V	14.0000 0 ±
15	.1500000	15.0V	15.0000 0 ±15
16	.1600000	16.0V	16.0000 0 ±15

6-17. DC Buffer

6-18. Use the following procedure to complete the DC Buffer calibration adjustments:

1. Short the 8522A input terminals.

2. Select the volts dc function and the 100 mV range.

3. Select the 2 readings per second rate, which automatically selects the 500 msec filter.

4. Adjust C231 for a reading of .000 mV ± μV.

5. Select the 10 readings per second rate, which automatically selects the 100 msec filter.

6. Adjust C225 for equal alternations between the plus and minus signs.

7. Repeat steps 3 through 6 until both readings are within the stated tolerance without adjustment.

8. Remove the short on the input terminals and replace it with the 1 MΩ/1 μF parallel load.

9. Select the 2 readings per second rate then verify that the instrument displays .000 mV ±50 μV.

10. Remove the load from the input terminals.

11. Connect the 8522A to the DC Calibrator and Ratio Standard as shown in Fiigure 5.1 for a positive input to the 8522A.

12. Select a DC Voltage Calibrator output of 10V and set the Ratio Standard to .0190000.

13. Adjust R253 for an 8522A display reading of 190.000 mV ±2 digits.

14. Select the 1 volts range and the Cal digit feature on the 8522A.

15. Select the Ratio Standard to .190000.

16. Adjust R251 for an 8522A display reading of 1.90000 0 ±6 Cal digits.

17. Set the DC Calibrator to STANDBY and remove the ratio standard from the circuit, connecting the DC Calibrator directly to the 8522A for a positive input, i.e., HI to HI and LO to LO.

18. Select the 100 volts range on the 8522A.

19. Select a DC Voltage Calibrator output of 120.000V dc.

20. Adjust R109 for an 8522A display reading of 120.000 0 ±6 Cal digits.

21. Disconnect the DC Calibrator from the 8522A.

6-19. Ohms Converter

6-20. Complete the Ohms Converter calibration adjustments by performing, in sequence, each step in Table 6-3. Manually select the range indicated and short the input in step 1 at the far end of the input leads. When the adjustments are complete depress the CAL digit switch to disable the CAL digit feature.

Table 6-3. Ohms Converter Calibration

STEP	FUNCTION	RANGE IN OHMS	READING RATE	FILTER	STANDARD RESISTOR INPUT	ADJUSTMENT	DISPLAY ± CAL DIGIT
1	Ω4 WIRE	10	500msec	2/sec	Short	R325	.000 0 ±20
2	Ω4 WIRE	10k	500msec	2/sec	10k	R311	10.0000 0 ±15
3	Ω4 WIRE	1000	500msec	2/sec	1k	R314	1.00000 0 ±15
4	Ω4 WIRE	100	500msec	2/sec	100	R317	100.000 0 ±15
5	Ω2 WIRE	100k	Fast	2/sec	100k	R315	100.000 0 ±20
6	Ω2 WIRE	1M	Slow	1/sec	1M	R319	1.00000 0 ±20

6-21. AC Converter

6-22. Use the following procedure to complete the AC Converter calibration procedures:

1. Select the AC plus DC function and the 1 volt range. The 2 readings per second rate and 500 msec filter are selected automatically with the function.

2. Short the 8522A input terminals.

3. Connect a test DMM set for the 100 mV dc range to J418 (HI) and TP402 (LO).

NOTE

TP402 is not placarded on the guard cover, however, it is accessible through the J418 or R440 slots.

4. Adjust R408 for a test DMM reading of 0.000 mV ±15 μV (15 digits). Record the reading.

5. Remove the short from the input terminals and the test DMM from the circuit.

NOTE

J418 is a removable jumper. Exercise caution removing the DMM probe from the jumper.

6. Connect a DC Voltage Standard to the 8522A input terminals for a negative input. The 8522A remains in the AC plus DC function and 1 volt range previously selected.

7. Perform steps 1 and 2 of Table 6-4. Repeat until both steps are within the stated tolerance without further adjustment.

8. Perform step 3 and 4 of Table 6-4. Repeat step 1 through 4 of the table until all are within the listed tolerance without further adjustment.

9. Select the AC voltage function and the 1 volt range. The 2 readings per second rate and 500 msec filter are selected automatically with the function.

10. Repeat steps 1 through 5 of the procedure, adjusting R408 for the reading recorded in step 4.

11. Connect an AC Voltage Calibrator output to the 8522A input terminals.

12. Perform steps 1 through 8 of Table 6-5.

13. Remove the test equipment from the instruments.

14. The calibration procedure is complete.

Table 6-4. AC Converter AC + DC Calibration

STEP	INPUT	ADJUSTMENT	READING
1	—.0040000	R463	—.00400V ±50 μV (5 digits)
2	+.0040000	R445	+.00400V ±50 μV (5 digits)
3	—1.000000	—	Record Reading
4	+1.000000	R440	Recorded Reading +200 μV (20 digits)

Table 6-5. AC Converter AC Calibration

STEP	RANGE	INPUT	ADJUSTMENT	DISPLAY
1	1V	1.6V ac @ 200 Hz	R481	1.60000V +80 μV (8 digits)
2	10V	11V ac @ 200 Hz	R422	11.0000V ±600 μV (6 digits)
3	100V	100V ac @ 200 Hz	R433	100.000V ±6 mV (6 digits)
4	1000V	600V ac @ 200 Hz	R438	600.00V ±60 mV (6 digits)
5	1000V	600V ac @ 20 kHz	C403	600.00V ±150 mV (15 digits)
6	1V	1.6V ac @ 20 kHz	C408	1.60000V ±120 μV (12 digits)
7	10V	11V ac @ 20 kHz	R425	11.0000V ± 1.2 mV (12 digits)
8	100V	110V ac @ 20 kHz	R426	110.000V ±12 mV (12 digits)

6-23. NON-ROUTINE CALIBRATION ADJUSTMENTS

6-24. Introduction

6-25. The Calibration adjustments listed in the following sub-paragraphs are non-recurring in nature and should be performed only when a component has been changed in the applicable circuit. The others may be verified, if desired, at that time.

6-26. Preparing for Non-Routine Calibration

6-27. Allow a 2 hour warm-up period before beginning any of the procedures, then complete the Non-Routine Calibration Access procedure in Section 3 and perform the adjustments. When the procedure is complete replace the inner guard cover and allow the operating temperature to stabilize with an additional 30 minute warm-up period before doing a Performance Test or Routine Calibraton Adjustment.

6-28. Power Supply

6-29. Use the following procedure to complete the Power Supply calibration adjustments:

1. Connect the test DMM set for approximately 5V dc to TP201 (HI) and TP202 (LO) on the digital assembly.

2. Adjust R204 for a reading between +4.9 and +5.2V dc.

3. Transfer the test DMM leads to TP701 (HI) and TP702 (LO) on the Analog Assembly.

4. Adjust R710 for a reading between +4.9 and +5.2V dc.

5. Remove the test equipment from the instruments.

6-30. Auto Zero

6-31. Use the following procedure to complete the Auto Zero Calibration Adjustments:

1. Short the instrument input terminals.

2. Select volts dc, 100 mV range, and the 2 reading/sec rate (which automatically selects the 500 msec filter).

3. Connect an oscilloscope between TP206 and TP207 (ground).

4. Adjust R236 for an oscilloscope display with the squarewave amplitude less than 10 mV peak-to-peak as shown in Figure 6-2. (Suggested initial oscilloscope settings are 20 ms/cm and 100 mV/div, then adjust for at least two repetitions of the waveform.)

NOTE

The 10 mV waveform measurement is made on the body of the squarewave; ignore the spikes.

5. Remove test equipment from the instrument.

6-32. Reference Amplifier

6-33. Some units have a small PCB assembly installed in the A/D Converter section in place of U501. Two different configurations of the assembly are used, one parallel and the other perpendicular to the Analog Assembly; however, both are electrically identical. When the Ref Amp assembly is installed use the following procedure to re-adjust the circuit if any component in it is changed. If either U2, R15, or R16 fail, they must be replaced as a matched set.

1. Connect a test DMM to the cathode CR1 (HI) on the Ref Amp Assembly and TP501 (LO) on the A/D Converter section of the Analog Assembly.

NOTE

The point monitored is the electrical junction of R1, R2, R3, R15, and the cathode of CR1.

2. Adjust R3 on the Ref Amp Assembly for a DMM reading of 11V dc ±20 mV dc.

3. Remove the test equipment from the instrument.

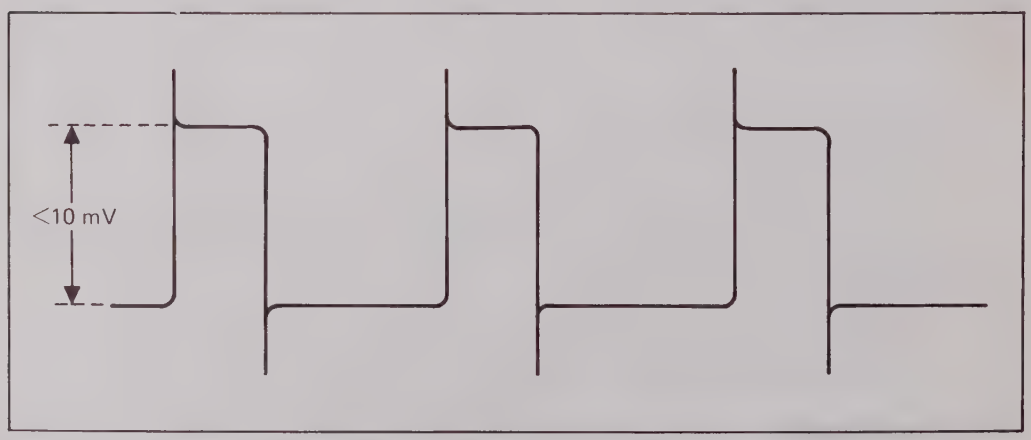

Figure 6-2. Auto Zero Calibration Waveform

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